# [1]Occupational Safety in Indian Factories: Analysing Trends and Policy Gaps for a Preventive Culture (2013-2022).

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## Abstract:

This study evaluates workplace safety in Indian registered factories from 2013 to 2022 by analyzing occupational safety and health data alongside the National Policy on Safety, Health and Environment at Workplace. Statistical analysis reveals a significant decline in non-fatal injury rates (from 191.18 to 16.79 per 100,000 employees, a 91.2% reduction) and a moderate reduction in fatal injury rates (from 9.34 to 5.93 per 100,000 employees, a 36.5% reduction). The Policy's emphasis on enforcement, compliance, and awareness aligns with these improvements, particularly post-2015. However, persistent fatal injuries, fluctuating dangerous occurrences, and gaps in data on occupational diseases and informal sectors indicate limitations in policy implementation. Recommendations include enhanced data collection, targeted interventions for high-risk sectors, and regular policy reviews to sustain progress toward a national preventive safety culture.

Keywords: Workplace Safety, Occupational Health, India, National Policy, Injury Rates, Statistical Analysis, Policy Evaluation

## 1. Introduction:

Workplace safety is a critical component of economic and social development, ensuring the well-being of workers and enhancing productivity. In India, with over 500 million workers, of whom less than 10% are covered by formal occupational safety and health (OSH) legislation, ensuring safe workplaces is a significant challenge (Saiyed and Tiwari, 2018). The Ministry of Labor and Employment's 2009 National Policy on Safety, Health, and Environment at Workplace promotes a preventive safety culture

through enforcement, compliance, awareness, and research. This study evaluates the Policy's effectiveness by analyzing occupational safety and health data for registered factories from 2013 to 2022, sourced from the Directorate General Factory Advice Service and Labor Institutes (DGFASLI) (Directorate General Factory Ad- vice Service and Labor Institutes, 2024).

The analysis examines trends in fatal and non-fatal injuries, dangerous occurrences, employment, and registered factories, correlating these with the Policy's objectives and action programs.

The paper addresses three research questions:

(1) To what extent has the Policy contributed to reducing workplace injuries?

(2) What gaps exist in its implementation?

(3) How can data collection and policy actions be improved?

## 2. Literature Review

Rapid industrialization, varied workforce, and complicated regulations demand for a competent and skilled occupational safety and health (OSH) professionals' and is an important area of study in India. The International Labor Organization (ILO) estimates that worldwide, 2.78 million workers die each year from workplace accidents and diseases, with India accounting for about 17% of these cases (International Labor Organization, 2019). This review looks at recent literature on workplace safety in India from 2013 to 2022. It focuses on trends in data, policy frameworks, and challenges in implementation. This context helps inform the current study's analysis of OSH data and the National Policy.

### 2.1. Statistical Trends in Workplace Safety

Research shows a mixed record of progress in India's OSH landscape. Earlier studies, based on DGFASLI data for 20032007, reported a 7% reduction in injuries but a 56% increase in fatalities. This indicates ongoing challenges in reducing severe incidents (Saiyed and Tiwari, 2018). More recent DGFASLI data (20132022) reveals a significant drop in non-fatal injuries, going from 26,852 to 2,983, which is an 85.7% reduction. There is also a moderate decrease in fatal injury rates, from 9.34 to 5.93 per 100,000 employees (Directorate General Factory Advice Service and Labor Institutes, 2024).

However, these statistics only relate to registered factories and do not account for the informal sector, which employs over 90% of India's workforce (Pandey, 2018). Singh (2017) argues that under-reporting, especially in small-scale industries, and inconsistent data from states like Delhi and Gujarat during 20132014, weaken the accuracy of national statistics (Saiyed and Tiwari, 2018). Occupational diseases like silicosis (4.1%, 54.6% prevalence among miners) and byssinosis (28%, 47% in textile workers) are a serious issue.

Only 562 cases were reported from 20112016, which shows a lack of systematic monitoring (Saiyed and Tiwari, 2018; Drishti IAS, 2022). Kumar (2020) points out that high-risk sectors such as construction and mining still have high fatality rates due to poor safety measures.

The literature indicates that although injury rates have gone down, the continued occurrence of fatal incidents and occupational diseases reveals inconsistent progress across sectors.

## 2.2. Policy Frameworks and Implementation

The National Policy on Safety, Health, and Environment at Workplace (2009) establishes a framework for improving occupational safety and health (OSH) by enforcing national standards, ensuring compliance, raising awareness, and promoting research. It aligns with India's constitutional provisions and ILO conventions, including the Labor Inspection Convention (1947) and Labor Statistics Convention (1985). The policy emphasizes the need for tripartite consultation and engaging stakeholders (Drishti IAS, 2022). However, Shyam Sundar (2022) criticizes its implementation. He highlights issues such as fragmented legislation, low employment rates for inspectors (for example, 38.93% in Maharashtra in 2019), and weak labor statistical systems (Saiyed and Tiwari, 2018). The Occupational Safety, Health and Working Conditions Code, 2020, combines existing laws to expand OSH protections, but its effects are still not well-studied because it was enacted recently (Government of India, Ministry of Labor and Employment, 2020). Pandey (2018) points out enforcement challenges, including a shortage of labor inspectors and inadequate training, especially in the informal sector. The National Safety Council of India (NSCI) and the National Institute of Occupational Health (NIOH) have worked to promote safety awareness and conduct research, but their influence mainly covers organized sectors (Saiyed and Tiwari, 2018). Recent developments, such as digital tools for risk assessment and safety campaigns led by industries, indicate progress in organized sectors (Tiwari, 2024). However, Sharma (2021) argues that the lack of occupational health nursing and specialized training in medical programs limits the ability to address health risks at work.

## 2.3. Challenges in High-Risk and Informal Sectors

High-risk sectors, including construction, mining, and chemicals, face higher safety risks due to dangerous conditions and limited regulatory oversight (Kumar, 2020). Saiyed and Tiwari (2018) estimate that occupational hazards cost 2%-14% of India's gross national product, with construction and mining contributing many fatalities.

The informal sector, which makes up 90% of the workforce, does not have access to occupational health services. This increases risks such as silicosis and musculoskeletal injuries (Singh, 2017). Tiwari (2024) points out that greater awareness and media coverage have improved accident reporting. However, there is still a lack of culturally and linguistically tailored support for migrant and informal workers (UN Global Compact, 2019).

## 2.4. Gaps in Literature and Research Needs

The literature identifies several gaps that are important for this study. First, data limitations restrict thorough OSH monitoring, especially for occupational diseases and informal sectors (Singh, 2017). Second, there are few empirical evaluations of the National Policy's impact after 2013 (Shyam Sundar, 2022). Third, the role of new technologies, like IoT-based monitoring, isn't well explored in India (Kings Expo media Ltd., 2024). Finally, there is a lack of detailed analyses of policy implementation in high-risk sectors and among vulnerable groups, such as migrant workers. This study addresses these gaps by analyzing DGFASLI data (2013-2022) and evaluating the National Policy's effectiveness. It provides both a quantitative and qualitative assessment of workplace safety trends and policy outcomes.

## 3. Methodology

### 3.1. Data Source

The study uses Occupational Safety and Health Data for Registered Factories in India (2013-2022) from the DGFASLI Report for October to December 2024. The variables include Registered Factories, Employment, Dangerous Occurrences, Fatal Injuries, Non-fatal Injuries, and Total Injuries.

## 3.2. Statistical Analysis

The analysis includes:

3.2.1. **Injury Rates:** Fatal and non-fatal injury rates per 100,000 employees, calculated as: Injury Rate = Number of Injuries × 100, 000 Employment

3.2.2. **Percentage Changes:** Year-on-year changes in injuries, employment, and factories, using:

Percentage Change =          Value Year N – Value Year N-1× 100 Value Year N-1

3.2.3. **Correlation Analysis:** Pearson correlation coefficients to explore relationships between employment, factories, and injuries.

3.2.4. **Trend Analysis:** Examination of temporal trends in injuries and dangerous occurrences.

## 3.3. Policy Evaluation:

The Policy's goals, objectives, and action programs are compared to statistical outcomes to check their effectiveness. Key areas include enforcement (Section 4.1), compliance (Section 4.3), awareness (Section 4.4), and data collection (Section 4.7).

## 4. Results

## 4.1. Statistical Findings

Table 1: Injury Rates per 100,000 Employees (2013–2022)

| Year | Employment | Fatal Injuries | Non-fatal Injuries | Fatal Injury Rate | Non-fatal Injury Rate |
|------|-----------|----------------|--------------------|-------------------|-----------------------|
| 2013 | 14,042,410 | 1,312 | 26,852 | 9.34 | 191.18 |
| 2014 | 20,034,859 | 1,266 | 25,500 | 6.32 | 127.29 |
| 2015 | 16,374,546 | 1,107 | 20,257 | 6.76 | 123.70 |
| 2016 | 17,376,854 | 1,189 | 5,367 | 6.84 | 30.88 |
| 2017 | 16,409,493 | 1,084 | 4,866 | 6.61 | 29.65 |

| | | | | | |
|---|---|---|---|---|---|
| 2018 | 18,742,733 | 1,154 | 4,528 | 6.16 | 24.16 |
| 2019 | 18,552,909 | 1,127 | 3,927 | 6.07 | 21.16 |
| 2020 | 20,298,387 | 1,050 | 2,832 | 5.17 | 13.95 |
| 2021 | 17,414,912 | 988 | 2,803 | 5.67 | 16.10 |
| 2022 | 17,767,088 | 1,053 | 2,983 | 5.93 | 16.79 |

4.1.1. **Injury Rates**: Final injury rates fell to 5.93/100,000 employees in 2022 compared with 9.34 in 2013, a 36."5% lower. Non-fatal injury rates dropped 191.18 to 16.79, a decrease of 91.2%

4.1.2. **Total Injuries**: Declined from 28,164 in 2013 to 4,036 in 2022, which is an 85.7% reduction. There was a sharp drop in 2016, with a 69.31% decrease.

4.1.3. **Dangerous Occurrences**: Dangerous Occurrences: These varied between 634 in 2020 and 1,534 in 2014, with no clear trend.

4.1.4. **Employment and Factories**: Employment reached a high of 20,298,387 in 2020, and the number of factories peaked at 364,268 in 2018.

4.1.5. **Correlations**: The relationship between employment and total injuries showed a strong negative correlation of about -0.8. In contrast, the relationship between factories and injuries had a weak negative correlation of around -0.3.

## 4.2. Policy Evaluation

4.2.1. Objective 3.1a (Reduction in Injuries): There has been significant progress in reducing non-fatal injuries and moderate progress in fatal injuries.

4.2.2. Objective 3.1b (Data Coverage): There is complete injury data for registered factories, but there is no data on occupational diseases or informal sectors.

4.2.3. Objective 3.1c (Awareness): The drop in injuries suggests that awareness campaigns are working, though we lack direct evidence.

4.4.4. Action Programs: Enforcement (Section 4.1) and compliance (Section 4.3) likely helped reduce injuries, but ongoing fatal injuries show that there are still gaps in addressing high-risk sectors.

## 5. Discussion

The significant drop-in non-fatal injury rates (91.2%) matches the Policy's goal of ongoing injury reduction (Government of India, Ministry of Labor and Employment, 2009). Enforcement methods, like labor inspections (Section 4.1.2), and compliance systems, including safety management protocols (Section 4.3.9), likely drove these improvements, especially after 2015. The sharp decline in 2016 may reflect safety improvements driven by the Policy, such as the adoption of standardized safety protocols (Section 4.2) or changes in reporting standards, which need further investigation. However, the steady fatal injury rate (59 per 100,000 employees) shows that high-risk operations, like those involving hazardous chemicals or machinery (Section 1.8), remain a challenge. This supports findings by Kumar (2020), who pointed out ongoing risks in India's construction and manufacturing sectors.

The Policy's focus on preventing serious incidents (Section 4.3.4) and research (Section 4.5) seems to be insufficiently implemented in these areas. Changes in dangerous incidents indicate uneven hazard prevention, possibly due to inconsistent enforcement across regions (Shyam Sundar, 2022). The datasets with strong injury data support the Policy's goals for data collection (Section 4.7), but gaps in data on occupational diseases and the informal sector limit thorough monitoring (Singh, 2017). The impact of the COVID-19 pandemic in 20202021, which reduced employment and factory operations, likely contributed to fewer injuries, showing the Policy's importance in tackling evolving workplace challenges (Section 1.6). The absence of data on green jobs or environmental performance limits the evaluation of Objective 3.1e, indicating a need for broader metrics (Tiwari, 2024).

## 6. Limitations

1. Data Scope: This is limited to registered factories. It does not include informal sectors or occupational diseases (Section 4.7.3).

2. Reporting Changes: The drop in non-fatal injuries in 2016 might result from administrative changes, not actual safety improvements.

3. Lack of Contextual Data: There are no industry-specific or regional breakdowns to pinpoint high-risk sectors (Section 1.8).

4. Environmental Metrics: The absence of data on green jobs or environmental performance makes it difficult to assess Objective 3.1e.

5. Implementation Evidence: There is no clear evidence of specific policy actions, such legislative changes or training programs.

## 7. Recommendations

1. Expand data collection to include occupational diseases and informal sectors (Section 4.7.3).

2. Target high-risk sectors like construction with enhanced enforcement and research (Sections 4.1, 4.5).

3. Investigate the 2016 non-fatal injury drop to confirm Policy impact.

4. Integrate environmental performance indicators to evaluate green job initiatives
 (Section 3.1e).

5. Strengthen awareness campaigns for vulnerable groups, such as migrant workers (Section 1.7).

6. Implement regular Policy reviews every five years (Section 4.8.2).

7. Develop financial and non-financial incentives to encourage compliance (Sections 4.1.8, 2.3).

## 8. Conclusions

Between 2013 to 2022 non-fatal injury rate decreased due to effective enforcement, compliance, and awareness efforts. However, stable fatal injury rates and gaps in data on occupational diseases and informal sectors reveal limitations in tackling high-risk operations and vulnerable groups. Improved data collection, targeted efforts, and regular reviews are crucial for maintaining progress and building a national safety culture. The Policy's framework, based on constitutional and international standards, offers a solid foundation, but its success relies on addressing implementation gaps through collaboration among stakeholders.

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